DOCUMENT RESUME

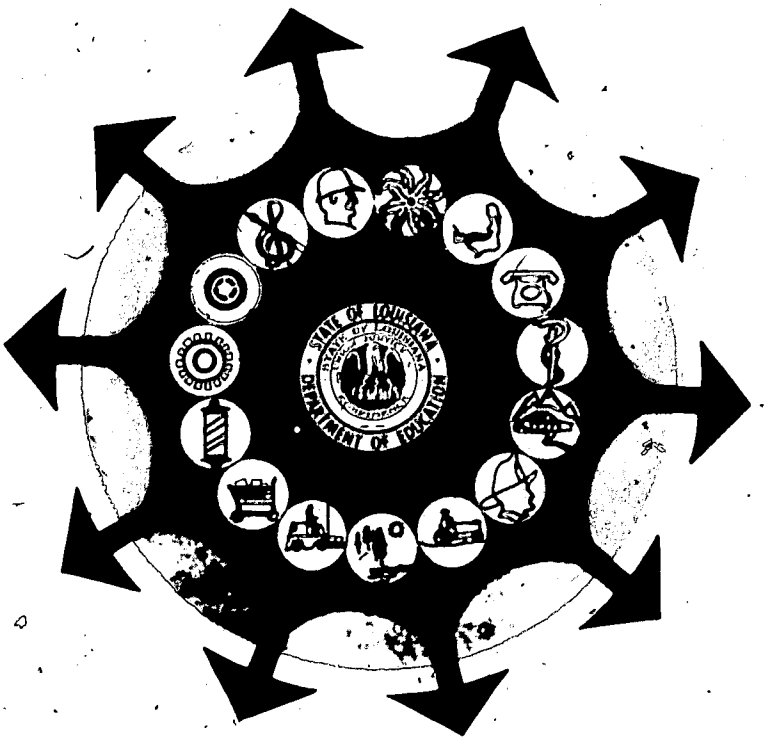
ED 117 572 CE 006 289

AUTHOR Ohmer, Merlin M.; And Others
TITLE Algebra II. Mathematics Curriculum Guide (Career Oriented).
INSTITUTION Louisiana State Dept. of Education, Baton Rouge.
REPORT NO Bull-1283; VT-102-468
PUB DATE May 74
NOTE 59p.; For related documents, see CE 006 282-291

EDRS PRICE MF-$0.83 HC-$3.50 Plus Postage
DESCRIPTORS *Algebra; Behavioral Objectives; *Career Education; *Curriculum Guides; Learning Activities; Mathematical Applications; Mathematics Curriculum; *Secondary Education
IDENTIFIERS Louisiana

ABSTRACT

The curriculum guide for Albegra 2 correlates algebraic concepts with career-oriented concepts and activities. The curriculum outline format gives the concepts to be taught, matched with related career-oriented performance objectives, concepts, and suggested instructional activities in facing page layouts. The suggested curriculum outline is compatible with all books on the approved textbook lists for Louisiana. The outline is divided into the following major headings: review of sets and the real number system; equations and inequalities; complex number system; relations, functions, and conic sections; exponential and logarithmic functions; sequence, series, and the binomial theorem; permutations, combinations, and probability; and introductory trigonometry. (NJ)



MATHEMATICS CURRICULUM GUIDE
CAREER ORIENTED
ALGEBRA II

Louisiana State Department of Education
Louis J. Michot, Superintendent
1974

BULLETIN NO. 1283

STATE OF LOUISIANA
DEPARTMENT OF EDUCATION
LOUIS J. MICHOT
STATE SUPERINTENDENT
P. O. BOX 44064
BATON ROUGE, LOUISIANA 70804

September, 1974

Dear Teacher:

This new curriculum guide in mathematics has been developed to assist you in implementing career education concepts. In order for it to make your instruction easier, it is important that you understand the philosophy and rationale that undergird the guides.

You will note that this guide is for a particular level. The level indicates the normal grade placement for the elementary grades. High school guides are for particular subjects. They are in loose leaf form and are punched for a three-ring notebook. This design was intentional in order to permit greater utilization in non-graded or multi-level teaching.

The format is particularly important in that the curriculum outline giving the concepts to be taught is matched with performance objectives, career concepts and suggested instructional activities in facing page layouts. The suggested curriculum outline is compatible with all books on the approved state textbook list. The curriculum outline is not considered inclusive but sufficient concepts are included to meet an adequate curriculum at each level.

There are by design numerous blank spaces on the pages to permit teacher notes, write-in activities, etc. It is desired that teachers be innovative and the loose leaf format provides for inclusion of additional pages as needed.

We ask that teachers who develop good instructional activities submit them to the State Department to be printed and shared with other schools and systems.

Future revisions will also be made in loose leaf form, and this will permit keeping guides current from year to year.

If further assistance is needed in implementing the guides, please contact Dr. Elton L. Womack, State Supervisor of Mathematics, State Department of Education, Post Office Box 44064, Baton Rouge, LA 70804.

Sincerely,

Elton L Womack

Elton L. Womack, Ed. D.
Supervisor of Mathematics

ELW:pw

VT 102468

MATHEMATICS CURRICULUM GUIDE

(CAREER ORIENTED)

ALGEBRA II

LOUISIANA STATE DEPARTMENT OF EDUCATION

Louis J. Michot

State Superintendent

May 1974

ACKNOWLEDGEMENTS

Appreciation is expressed to the following committee persons whose untiring efforts have produced this revision of the Career Oriented Curriculum Guide for Algebra II.

Dr. Merlin M. Ohmer, Chairman	Dean of Sciences Nicholls State University Thibodaux, Louisiana
Mr. Dale Fredrick	Mathematics Coordinator ESEA Title III Lafayette Parish Schools Lafayette, Louisiana
Mr. Dale Hester	Associate Professor of Mathematics Nicholls State University Thibodaux, Louisiana
Mr. Joseph Jones	Mathematics Teacher Mansfield High School Mansfield, Louisiana
Mrs. V. Alexandra Nuschler	Mathematics Teacher Chalmette High School Chalmette, Louisiana
Mrs. Marguerite Sanders	Coordinator Federal Programs Curricula Sabine Parish Schools Many, Louisiana

Gratitude is also expressed to the many individuals who field tested the previously published "working draft" and offered constructive suggestions.

PREFACE

The first working draft of the Mathematics Curriculum Guide, Secondarl Level, was distributed for field testing for the 1973-74 academic year. Feedback indicated that the materials were appropriate for the purposes as stated in the original preface.

The materials presented herein have been changed from the original only in that the mathematical language has been made as uniform as possible for clarity and to conform to the texts adopted by the State of Louisiana. Additional career learning activities have been introduced.

The format has been revised so that it should be easier to correlate the curriculum outlines and performance objectives with the related career oriented concepts and learning activities.

The reader who is seeing the materials for the first time can be assured that the career approach of these guidelines in no way weakens the present program. As in all good educational procedures, materials are included so that all levels may be served. In addition to the ambitious minimum recommendations the guidelines contain ample extension materials for those students who need to be challenged.

Mathematics is embedded in all of the disciplines and makes a solid base for experiences in career education. This is borne out by the numerous references and career activities from the spectrum of life.

The student is led in a systematic development that is designed to provide for continuous progress. Dignity of the person was always foremost in devising and revising the guidelines. The goals were set to give maximum development of the individual through all types of educational experiences.

Finally, our schools will always have a basic curriculum. The methods of instruction will be constantly changing, and the counselors will continue to lend their influence in guiding the pupil. The career education goals which are interwoven with the traditional will help make more productive citizens of Louisiana's most important assets, its children.

TABLE OF CONTENTS

ALGEBRA II

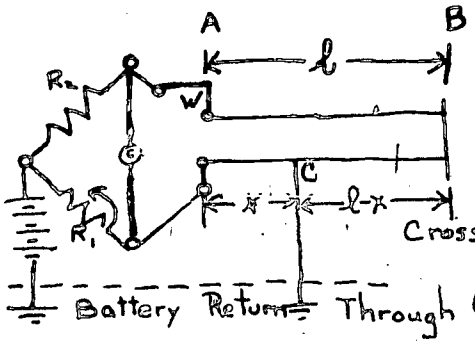
CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
I. Review of Sets and the Real Number System	I. Review of Sets and the Real Number System
A. Sets	A. To demonstrate a basic understanding of sets, the student should be able to:
1. Description	1. Describe a set by listing and/or by the use of set-builder notation.
2. Union	2. Compute the union of two sets.
3. Intersection	3. Compute the intersection of two sets.
4. Complement	4. Compute the complement of a set.
5. Subset	5. Determine whether set A is a subset of set B.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
I. Career Concept Careers require different levels of competence in computation. Performance Objectives A. A registrar must schedule students. In order to allow sufficient sections of courses without conflicts, he uses Venn diagrams.	A. During a recent semester each student at River City College was enrolled in at least one of the three courses--English, history, and mathematics, the mathematics department reported 500 students enrolled; the English department reported an enrollment of 1,000, and the history department reported 700. The registrar revealed that 200 students were enrolled in both mathematics and history, 300 were enrolled in both mathematics and English, and 400 were enrolled in both English and history. The Assistant registrar noted that 100 students had schedules all three of the courses for that semester. Determine the student enrollment at River City College for the semester. Hint: A Venn diagram is helpful.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
B. Real Numbers	B. To demonstrate a working knowledge of real numbers (the signed numbers and zero) the student should be able to:
1. Definitions and classification	1. Define rational number, define irrational number, and classify any real number as a rational or irrational number.
2. Representation	2. Convert a common fraction a/b to decimal form and convert from decimal form to a/b form.
3. Absolute value	3. Determine $\|a\|$ for any real number a.
4. Operations	4. Add two signed numbers, multiply two signed numbers, subtract one signed number from another, and divide a signed number by a signed number.
5. Simplifying expressions	5. Simplify a numerical expression by performing the indicated operations on signed numbers in the proper order.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
C. The field of real numbers	C. To demonstrate an understanding of the field properties, the student should be able to:
1. Closure property a. Addition b. Multiplication	1. Exemplify each of the closure properties.
2. Commutative property a. Addition b. Multiplication	2. Exemplify each of the commutative properties.
3. Associative property a. Addition b. Multiplication	3. Exemplify each of the associative properties.
4. Identity property a. Addition b. Multiplication	4. Exemplify each of the identity properties and name the additive identity and the multiplicative identity.
5. Inverse property a. Addition b. Multiplication	5. Exemplify each of the inverse properties and name the real number which does not have a multiplicative inverse.
6. Distributive property for multiplication over addition	6. Use the distributive property to: a. Express the sum of two numbers as the product of two numbers (e.g., $4+8=4(1+2)$). b. Express the product of two numbers as the sum of two numbers (e.g., $3(2+4)=6+12$).

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
C. Telephone field men constantly have to deal with trouble along the line. The real number properties properties as applied to formulas are important in this kind of work.	C. During a storm a defect occurred in a two-wire circuit joining points A and B which were 60 miles apart. One method of locating a defect of this kind is the Murray Loop Test, a diagram of which is shown below. The formula $\frac{x}{2L-x} = \frac{R_1}{R_2}$ gives the relationship between the resistances R_1 and R_2, measured in ohms, and the distances l and x, when the resistances of the two wires joining A and B are equal. The distance from point A to the defect (represented by x in the formula) can be determined when R_1, R_2, and L(the distance from A to B) are known. In this care the engineer sent one of his men to make a cross of the wires at B. He connected a Wheatstone bridge to the two wires at A. He used 1000 ohms resistance for R_2 and adjusted the resistance R_1 to balance the bridge. The bridge balanced when R_1 was 146 ohms. By substituting known values in the formula given above, he obtained the equation $\frac{x}{120-x} = \frac{146}{1000.}$ Solving for x, he found that the defect was 15.29 miles from A. 

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
D. Theorems	D. To further demonstrate understanding of the field properties, the student should be able to use the field properties to prove simple theorems.
E. Algebraic expressions	E. To demonstrate a basic knowledge concerning algebraic expressions, the student should be able to:
1. Definitions	1. Define variable, term, like terms, coefficient, monomial, binomial, trinomial, and polynomial.
2. Addition	2. Add one expression to another
3. Subtraction	3. Subtract one expression from another.
4. Multiplication	4. Multiply one expression by another.
5. Division	5. Divide one expression by another.
6. Simplification	6. Simplify an expression by removing the symbols of grouping and combining like terms.
7. Evaluation	7. Evaluate an algebraic expression given replacement values for the variables.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
F. Exponents	F. To demonstrate a basic understanding of exponents, the student should be able to:
1. Definition and symbolism	1. Define an exponential with integral exponent.
2. Theorems	2. Illustrate: a. $a^m \cdot a^n = a^{m+n}$ b. $(a^m)^n = a^{mn}$ c. $(ab)^n = a^n b^n$ d. $a^m \div a^n = a^{m-n}$ e. $(\frac{a}{b})^n = \frac{a^n}{b^n}$
3. Simplication of expressions	3. Use the exponential theorems to simplify expressions containing exponents.
4. Scientific notation	4. Express a number using scientific notation.
G. Factoring	G. To demonstrate a basic understanding of factoring, the student should be able to determine the prime factorization of a selected polynomial.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
F. Chemical technicians work in reserach and development, testing or other laboratory work. In these endeavors many measuring instruments are employed and their measure interpreted in scientific notation.	F. Technicians use a special balance scale for weighing small quantities. Such a balance can weigh a quantity as small as .0000001 gram which could contain more than 10,000,000,000,000 atoms. Express these quantities in scientific notation.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
II. Equations and Inequalities	II. Equations and Inequalities
A. Equations	A. To demonstrate a basic understanding of linear equations and quadratic equations, the student should be able to:
1. Linear solution	1. Solve a linear equation in one variable.
2. Classification of a linear system	2. Classify a system of two linear equations in two variables as inconsistent, consistent and dependent, or independent and give a geometric interpretation of the classification.
3. Solution of a linear system	3. Determine the solution set of a system of two linear equations in two variables.
4. Quadratic equations	4. Solve a quadratic equation in one variable by: a. Factoring b. Completing the square c. Quadratic formula
5. Fractional equations	5. Solve fractional equations.
6. Problem solving	6. Use the theory of equations to solve selected physical problems; i.e. verbal problems.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
II. Career Concepts Careers require different levels of competence in analysis. Performance Objectives A. Law enforcement covers many areas. Some officers, who are experts in the field of ballistics, require special training to apply engineering techniques to their specialty.	A. If a projectile is fired directly upward with an initial velocity of n ft. per second, its distance from earth after t seconds is given by the formula $d = nt - 16t^2$. The formula defines a quadratic function of t, and its graph is a parabola. The y-coordinate of the vertex represents the maximum height attained by the projectile. If the initial velocity is 1600 ft. per sec., how high is the projectile at t = 20? at t = 40? at t = 80? When does the projectile attain its maximum altitude?

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
B. Inequailities	B. To demonstrate a basic understanding of inequalities, linear and quadratic, the student should be able to:
1. Linear	1. Solve and graph a linear inequality.
2. Quadratic	2. Solve and graph a quadratic inequality.
3. Systems of linear inequalities	3. Determine the solution set of a system of linear inequalities by graphing.
C. Extension of the theory of equations	C. To extend the above concepts and skills, the student should be able to solve a system of more than two linear equations in more than two variables.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
B. A cost accountant must be able to apply the concept of inequalities to the field of manufactoring in order to determine the number of each model a manufacturer should produce for the greatest profit.	B. A television manufacturer makes two basic models of color television sets--a portable model and a console model. The company has the equipment to manufacture any number of portable models up to (and including) 400 per month or any number of console models up to 300 per month. It takes 80 man-hours to produce a portable model, and 100 man-hours to produce console sets. The firm has up to 40,000 man-hours available for television production each month. If the profit gained on each portable model is $50 and on each console model is $70, determine the number of each model of set the firm should manufacture to gain the maximum profit each month.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
III. Complex Number System	III. Complex Number System
A. Roots and radicals	A. To demonstrate a basic understanding of roots and radicals, the student should be able to:
1. Real roots and principal root	1. Determine whether a real number "a" has real nth roots (for a positive integer n), and if it does, identify principal nth root.
2. Radical notation	2. Use radical notation to denote real roots; i.e., express a real root as a radical.
3. Radicand and index	3. Identify the radicand and index of a radical.
4. Simplification of radical expression	4. Express a radical, sum of radicals, or product of radicals in simplest form, and rationlize denominators whereever necessary.
B. Imaginary numbers	B. To demonstrate a basic understanding of imaginary numbers, the student should be able to:

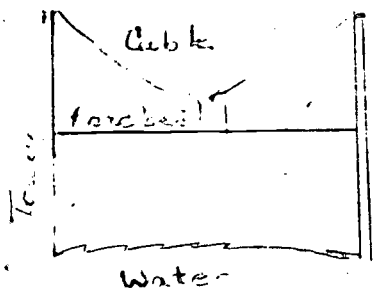
RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
III. Career Concepts	
Performance Objectives	
A. Mathematicians, chemists, physicists, and many other scientists use irrational numbers in their calculations. They must know how to simplify a radical expression to facilitate the computation of a rational approximation.	A. Determine a rational approximation of the irrational number $\frac{1}{\sqrt{3}} + \frac{2}{\sqrt{2}}$.
B. An electrical engineer uses imaginary numbers to facilitate the computations involved in the solutions of practical problems concerning alternating current.	

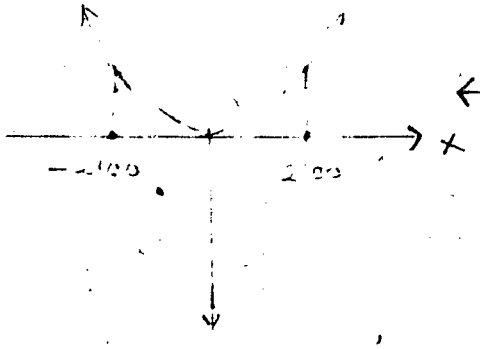
CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
1. Definition	1. Define an imaginary number.
2. Classification	2. Distinguish between a pure imaginary number and an imaginary number which is not pure.
C. Complex numbers	C. To demonstrate a basic understanding of complex numbers, the student should be able to:
1. Definition	1. Define a complex number.
2. Classification	2. Classify any complex number a + bi; as real, pure imaginary, or nonpure imaginary.
3. Equality	3. Define equality of two complex numbers.
4. Operations	4. Divide a complex number by a non zero complex number, subtract one complex number from another, add two complex numbers, and multiply two complex numbers.
5. Geometric representation	5. Represent a complex number as a point in the complex plane.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
D. Field of Complex numbers	D. To demonstrate that the complex number system is a field, the student should be able to illustrate (with an example) that each field property is satisfied.
E. Quadratic equations	E. To demonstrate a basic understanding of quadratic equations with complex roots, the student should be able to:
1. Discriminant	1. Determine the discriminant of a quadratic equation and use it to determine the nature of the roots.
2. Solution of quadratic equations	2. Compute the roots of a quadratic equation by: a. Completing the square b. Applying the quadratic formula
3. Root-coefficient relations	3. Determine the sum and product of the roots by the coefficients of the terms of the quadratic equation.
4. Determination from roots	4. Determine a quadratic equation given its roots.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
E. The civil engineer applies the relationship of a quadratic equation to the design of a cable supported bridge in his calculation of the height of the towers supporting the bridge.	E. In constructing a particular suspension bridge the ends of the two suspension cables are attatched to the tops of the two supporting towers.





See sketches at left

The curve of each cable is described by the quadratic quation $\frac{97}{882,000} X^2 = Y$.

The midpoint of the cable (low point) is 300 feet above the surface of the water, and the horizontal distance between the two towers is 4,200 feet. Determine the height of the towers above the surface of the water.

Hint: Let the midpoint of the cable represent the vertex of a parabola with the equation $F(X) = \frac{97}{882,000} X^2$ (See sketch)..

$F(2100) = F(-2100) = \frac{97}{882,000}$ $(\pm 2100)^2 = 485$. Is the vertical distance from the low point of the cable to the top of the towers. Thus, 300 feet + 485 feet = 785 feet is the height of each tower above the surface of the water.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
##F. Extension	##F. To extend the above concepts and skills, the student should be able to:
1. Proof of irrationality	1. Prove $\sqrt{2}$ is irrational.
2. Radical equations	2. Solve an equation which contains more than one radical.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES

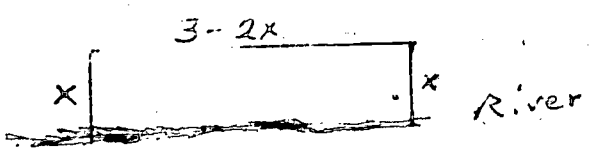
CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
IV. Relations, Functions, Conic Sections	IV. Relations, Functions, Conic Sections
A. Relations and functions	A. To develop a basic understanding of relations and functions, the student should be able to:
1. Definitions	1. Define relation, domain of relation, range of relation, and function.
2. Sets of ordered pairs	2. Distinguish between a set of ordered pairs that is a function and one that is not a function.
3. Domain and range	3. Describe the domain and range of a specific function.
4. Graphing	4. Sketch the graphs of selected functions and relations.
5. Variation	5. Express statements of direct, inverse, and joint variation in functional notation and solve variation problems.
B. Polynomial functions	B. To demonstrate a basic understanding of polynomial functions, the student should be able to:

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
IV. Career Concept Careers are effected by the ability of individuals to relate to each other. Performance Objectives	
B. Mathematicians, as well as other scientists, are creative and use their knowledge to explore the unknown.	B. The quadratic formula provides a technique for solving a polynomial equation of degree 2. The history of the search for techniques to solve polynomial equations of higher degree is very interesting.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
1. Definition	1. Define a polynomial function and state its degree.
2. Synthetic division	2. Use synthetic division.
3. Remainder and factor theorems	3. Understand and apply the remainder and factor theorems.
4. Descartes' Rule of Signs	4. Use Descartes' Rule of Signs to determine the number of possible positive and negative roots of an equation.
5. Location Theorem	5. Use the Location Theorem to help locate roots.
6. Linear interpolation	6. Determine a rational approximation of a zero of a polynomial function by linear interpolation.
C. Conic sections	C. To demonstrate a basic understanding of the conic sections, the student should be able to:
1. Classical concept	1. Visualize a conic section as the intersection of a plane and a cone.
2. Identification and analysis	2. Examine a quadratic equation which describes a conic section and determine whether its graph is a parabola, circle, ellipse, or hyperbola. Determine (where applicable) the coordinates of its center,

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
	It reveals that great mathematicians were often as guilty of petty jealousy and other emotional weaknesses as their lesser known contemporaries. See: D. J. Struik, A Concise History of Mathematics, 3rd. ed. rev. (New York: Dover Publication, Inc., 1967), pp. 108-14. E. T. Bell, Men of Mathematics (New York: Simon and Schuster, 1961), pp. 309-12. O. Ore, Cardano, The Gambling Scholar, trans. S. H. Gould (New York: Dover Publications, Inc., 1965), pp. 61-84. C. H. Boyer, A History of Mathematics (Somerset, New Jersey: John Wiley and Sons, Inc., 1968), pp. 310-15.
C. A rancher, in order to take advantage of natural boundaries, uses the graph of a quadratic function (parabola) to determine maximum area with fixed fencing.	C. A rancher has three miles of wire fencing material which he plans to use to enclose some of his land along side a river. He wants to create a rectangular enclosure by constructing three of the sides from fencing material and letting the bank of the river be the fourth side as illustrated in the accompanying sketch. He also wants the area of the enclosure to be as great as possible using three miles of fencing. What should be the dimension of the rectangular enclosure to obtain maximum area:

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
	verticis, and foci, and equations for its directrices, asymptotes, and axes.
3. Graph	3. Sketch any conic section.
4. Equation	4. Determine an equation of a conic section from given data.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
	 If X miles is the depth of the enclosure, then the area is obviously $A(X) = X(3-2X) = -2X^2 + 3X$. Since the graph of A is a parabola opening downward, it follows that the function A attains maximum value on the abscissa. $X = \frac{-b}{2a} = \frac{3}{4}$ of the vertex. Hence the desired dimensions of the rectangular enclosure are 3/4 miles by 3/2 miles.
Astronomers employ the study of conic sections to their study of celestial bodies.	Comets travel in orbits that are conic sections. Those that are part of our solar system, including Halley's Comet, have elliptical orbits. Other comets with greater speeds follow parabolic and hyperbolic orbits. Do you think that comets traveling in any of these orbits ever pass near the earth more than once? Which ones?
The landscape architect not only lays out the plan for landscaping an estate but also designs the fences, retaining walls, and gates.	The top of a rectangular garden gate is to be cut so that it has an elliptical shape. If the gate is 3 feet wide and a semi-minor axis of the ellipse is 1 foot long, determine the foci so that the ellipse may be sketched on the gate (using the string method) as a pattern for cutting.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
D. Solution of quadratic system	D. To develop a basic understanding of quadratic systems, the student should be able to:
1. Graphical method	1. Compute solution(s) or approximate solution(s) of a system of quadratic equations in two variables by graphing.
2. Algebraic method	2. Determine by algebraic techniques the solution set of a system of quadratic equations in two variables.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
Audio therapists require a basic knowledge of graphing to relate data.	The length of a vibrating string is related to the frequency of the tone it emits. Plot a graph of the following data for a typical vibrating string, using length as abscissas and frequencies as ordinates.

Length	Frequency (Cycles/sec)
7.50	1024
15.0	512
20.0	384
30.0	256
40.0	192
60.0	128
80.0	96
120	64
240	32

1. What is the shape of the graph?
2. What relationship exists between the length of a vibrating string and the frequency of the tone it emits?

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
##E. Extension	##E. To extend the above concepts and skills, the student should be able to translate axes and sketch graphs (of conic sections) which are not in standard position.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
V. Exponential and Logarithmic Functions	V. Exponential and Logarithmic Functions
A. Exponential function	A. To demonstrate a basic understanding of an exponential function the student should be able to:
1. Definition	1. Define an exponential function.
2. Graph	2. Graph an exponential function.
B. Logarithm	B. To demonstrate a basic understanding of logarithms, the student should be able to:
1. Definition	1. Define logarithm to the base b, $b > 0$ and $b \neq 1$.
2. Laws	2. Use the laws of logarithms and the definition of a logarithm to (a) Convert an equation to logarithmic form to an equation in exponential form. (b) Convert an equation in exponential form to an equation in logarithmic form.
3. Function	3. Define, state the domain, state the range, and sketch the graph of the logarithmic function.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
V. Career Concept Individuals adapt to world changes and environment. Performance Objectives	
A. A research technician often plots several sets of data on the same graph in order to compare data and to determine the most reliable solution.	A. Sketch the graphs of the exponential functions $f(x) = (1/2)^x$, $g(x) = 2^x$, and $h(x) = 2^{2x}$ on the same coordinate plane. Tell without sketchings the graph of $j(x) = (7/8)^x$ which of the three previous graphs will be similar to the graph of j.
B. Banking personnel are frequently involved in working problems, the solution of which is not always found in tables. In dealing with interest formulas, logarithms can be applied.	B. If p dollars are invested in a savings account and interest is computed at the rate r, compounded m times per year, for m years, the amount, A, in the account will be $A = p(1 + \frac{r}{m})^{mm}$ [provided no withdrawals are made]. Use logarithms to compute the amount for \$1,000 invested for 15 years at 5% compounded monthly.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
4. Comparison of graphs	4. Explain how the graph of the exponential function and the graph of the logarithmic are related with respect to the line $y = x$.
5. Common	5. Determine the characteristic of the common log of a number, and use a table of common logarithms (together with interpolation) to determine the mantissa of the logarithm.
6. Antilogarithm	6. Determine a number x when the common logarithm of x is given (e.g., compute the antilog of x).
7. Applications	7. Use the laws of logarithms and a table of common logs to: (a) Compute the product of two numbers (b) Compute the quotient of two numbers (c) Determine the decimal representation of an exponential (e.g., raise to a power or compute a root).
8. Equations	8. Solve a given logarithmic equation and use the theory of logarithms to solve equations of the type $4^x = 60$.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
VI. Sequence, Series, and the Binomial Theorem	VI. Sequence, Series, and the Binomial Theorem
A. Arithmetic Sequence	A. To demonstrate a basic understanding of arithmetic sequences (e.g., arithmetic progressions) the student should be able to:
1. Definition	1. Define an arithmetic sequence.
2. Common difference	2. Determine the common difference of a given sequence.
3. Formulas a. nth term b. arithmetic mean	3. Determine a particular term of a given arithmetic sequence. Compute an arithmetic mean (or means).
B. Arithmetic series	B. To demonstrate a basic understanding of arithmetic series, the student should be able to define an arithmetic series, distinguish between arithmetic sequence and arithmetic series and determine the sum of the terms of an arithmetic series.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
VI. Career Concepts Individual careers may change change as individuals change throughout life. Performance Objectives	
A. Pleasure boat dealers are often requested to accept a trade-in toward the purchase of a new boat. It can be helpful for the dealer to have a knowledge of arithmetic progression to readily determine the depreciation and/or current value.	A. A pleasure boat is purchased for $5800. During the first year it depreciates $900, and thereafter $350 per year. What is the value of the boat 11 years after its purchase? ($1400)

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
C. Geometric sequence	C. To demonstrate a basic understanding of geometric sequences (e.g., geometric progressions) the student should be able to:
1. Definition	1. Define a geometric sequence.
2. Common ratio	2. Determine the ratio (e.g., common ratio) of a given sequence.
3. Formulas	3. Determine a particular term of a given geometric sequence. Compute a geometric mean (or means).
D. Geometric series	D. To demonstrate a basic understanding of geometric series the student should be able to define a geometric series, distinguish between geometric sequence and geometric series, and determine the sum of the first n terms of a geometric series.
E. Binomial Theorem	E. To demonstrate a basic understanding of the binomial theorem, the student should be able to:
1. Factorial notation	1. Use factorial notation
2. Pascal's Triangle	2. Construct Pascal's Triangle
3. Binomial expansion	3. Expand a given binomial

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
C. Urban planners visualize future conditions in light of trends in population growth and social and economic change. They estimate the community long-range needs. Studies in population density are carefully analyzed.	C. The population of a certain city is now 60,000 and increases by 4% each year. Express this by a geometric sequence. What is the nth term? What will be the population in six years? In 20 years?

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
4. Determination of a specified term	4. Determine a specified term in the expansion of a given power of a binomial.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
VII. Permutations, Combinations, and Probability	VII. Permutations, Combinations and Probability
A. Permutations	A. To demonstrate a basic understanding of permutations, the student should be able to:
1. Defintion	1. Define a permutation of the elements in a set
2. Number	2. Determine: a. The possible number of permutations of n different elements. b. The possible number of permutations of n elements when the elements are not all different c. The number of permutations of n objects taken r at a time d. The number of circular permutations of a set of n objects

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
VII. Career Concept World changes, conditions, and environment affect careers. Performance Objectives A. The sports statistician applies the relationship of permutation to the batting order of a baseball team to determine, b mathematical calculation, the maximum number of possible batting orders on a baseball team.	A. A baseball league contains eight teams. In how many different orders can the teams finish the season? How many different possible outcomes are there for the first division (e.g. the top four)?

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
B. Combinations	B. To demonstrate a basic understanding of combinations, the student should be able to determine the number of combinations of n objects taken r at a time and explain why this number is less than or equal to the number of permutations of n objects taken r at a time.
C. Probability	C. To demonstrate a basic understanding of probability, the student should be able to:
1. Defintions	1. Define: sample space, probability of an event, and odds in favor of or against an event.
2. Sample space	2. Describe the sample space of a given experiment.
3. Event	3. List all possible events of a given sample space.
4. Outcome	4. Identify an outcome of a given experiment and distinguish from an event.
5. Odds	5. Distinguish between odds and probability in a particular problem.
6. Simple probability	6. Determine the simple probability of a specific event of a given experiment.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
B. It can be helpful to a member of a civic organization to be able to determine possible combinations.	B. A committee with three members is to be appointed in a club with 20 members. In how many ways can this be done?
C. One of the supporting jobs in the statistical research department of a large manufacturer of prescription medicine is titled statistical analyst. The work of an analyst includes the development of simple statistical data.	C. Tossing a penny, which may fall heads up or heads down, is a random experiment. Estimate the probability of a heads up by tossing a penny 100 times. What is the sample space? To simplify the work, put 10 pennies in the box, shake, and examine for the number showing heads up. Do this 10 times. This will give a reasonable approximation to the problem of making 100 tosses with a single penny.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
VIII. Introductory Trigonometry	VIII. Introductory Trigonometry
A. Trigonometric functions	A. To demonstrate a basic understanding of the trigonometric functions, the student should be able to:
1. Definitions	1. Define the six trigonometric functions.
2. Trigonometric tables	2. Use the tables of trigonometric functions to determine the value (or approximate value) of a function when given the angle measure, and to determine the angle measure (or approximate measure) when given the value of a function.
3. Interpolation	3. Use interpolation to obtain better approximation.
B. Applications	B. To demonstrate a basic understanding of the applications of trigonometry, the student should be able to use elementary trigonometry to solve selected physical problems; e.g., verbal problems.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
VIII. Career Concept Individuals may be suited for several different careers. Performance Objectives	
B. It is sometimes convenient and helpful for a painter (or other construction personnel) to have a working knowledge of simple trigonometry.	B. A painter is assigned to a job which requires him to repaint a firm's name on a brick wall. The name on the wall is 20 feet above the ground and the painter is issued a 25 foot ladder to use. He has learned from experience that it is not safe to use a ladder that forms an angle with the ground greater than 60°. Should he consider the 25 foot ladder safe to use?

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
##C. Extension	##C. To extend the above concepts and skills the student should be able to:
1. Radian measure	1. Define radian measure of an angle, convert degree measure to radian measure, and convert radian measure to degree measure.
2. Identities	2. Verify selected trigonometric identities.
3. Graphs	3. Sketch the graphs of simple trigonometric functions.

RELATED CAREER ORIENTED CONCEPTS AND OBJECTIVES	RELATED CAREER ORIENTED LEARNING ACTIVITIES
##C. Some tables of values of trigonometric functions include values for only the sine, cosine, and tangent functions. It is necessary for the user of such a table to know some elementary identities in order to determine values for the cotangent, secant, and cosecant functions.	##C. Determine $\cos 40^{\circ}$ from a table of values. Use this value and an elementary identity to compute $\sec 40^{\circ}$.